



## IGBT Discrete

|                       |             |          |
|-----------------------|-------------|----------|
| $V_{CE}$              | <b>650</b>  | <b>V</b> |
| $I_C$                 | <b>50</b>   | <b>A</b> |
| $V_{CE(SAT)} I_C=50A$ | <b>1.95</b> | <b>V</b> |

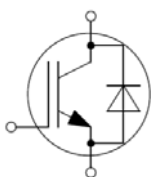
## Applications

- High frequency switching application
- Medical applications
- Uninterruptible power supply
- Motion/servo control

## Features

- Low switching losses
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High ruggedness, temperature stable
- High short circuit capability(5us)

### Circuit



## Maximum Ratings

| Parameter                                                                               | Symbol      | Value     | Unit    |
|-----------------------------------------------------------------------------------------|-------------|-----------|---------|
| Collector-Emitter Breakdown Voltage                                                     | $V_{CE}$    | 650       | V       |
| DC Collector Current, limited by $T_{jmax}$<br>$T_C=25^{\circ}C$<br>$T_C=100^{\circ}C$  | $I_C$       | 100<br>50 | A       |
| Diode Forward Current, limited by $T_{jmax}$<br>$T_C=25^{\circ}C$<br>$T_C=100^{\circ}C$ | $I_F$       | 80<br>40  | A       |
| Continuous Gate-Emitter Voltage                                                         | $V_{GE}$    | $\pm 20$  | V       |
| Transient Gate-Emitter Voltage                                                          | $V_{GE}$    | $\pm 30$  | V       |
| Turn off Safe Operating Area $V_{CE} \leq 1200V$ ,<br>$T_j \leq 150^{\circ}C$           |             | 200       | A       |
| Pulsed Collector Current, $V_{GE}=15V$ ,<br>$t_p$ limited by $T_{jmax}$                 | $I_{CM}$    | 200       | A       |
| Diode Pulsed Current, $t_p$ limited by $T_{jmax}$                                       | $I_{Fpuls}$ | 120       | A       |
| Short Circuit Withstand Time,<br>$V_{GE}=15V$ , $V_{CC}=400V$ , $V_{CEM} \leq 650V$     | $T_{sc}$    | 5         | $\mu s$ |
| Power Dissipation, $T_j=175^{\circ}C$ , $T_c=25^{\circ}C$                               | $P_{tot}$   | 357       | W       |



|                                                                          |       |            |    |
|--------------------------------------------------------------------------|-------|------------|----|
| Operating Junction Temperature                                           | $T_j$ | -40...+175 | °C |
| Storage Temperature                                                      | $T_s$ | -55...+150 | °C |
| Soldering Temperature, wave soldering 1.6mm (0.063in.) from case for 10s |       | 260        | °C |

**Electrical Characteristics of the IGBT** ( $T_j = 25^\circ\text{C}$  unless otherwise specified):

| Parameter                            | Symbol        | Conditions                                                                                              | Min. | Typ.                 | Max.         | Unit |
|--------------------------------------|---------------|---------------------------------------------------------------------------------------------------------|------|----------------------|--------------|------|
| <b>Static</b>                        |               |                                                                                                         |      |                      |              |      |
| Collector-Emitter Breakdown Voltage  | $BV_{CES}$    | $V_{GE}=0V, I_C=250\mu A$                                                                               | 650  |                      | -            | V    |
| Gate Threshold Voltage               | $V_{GE(th)}$  | $V_{GE}=V_{CE}, I_C=0.8mA$                                                                              | 4.5  | 5.0                  | 5.5          | V    |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=50A$<br>$T_j=25^\circ\text{C}$ ,<br>$T_j=125^\circ\text{C}$<br>$T_j=150^\circ\text{C}$ |      | 1.95<br>2.30<br>2.40 | 2.40         | V    |
| Zero Gate Voltage Collector Current  | $I_{CES}$     | $V_{CE}=650V, V_{GE}=0V$<br>$T_j=25^\circ\text{C}$ ,<br>$T_j=150^\circ\text{C}$                         |      |                      | 0.25<br>4.00 | mA   |
| Gate-Emitter Leakage Current         | $I_{GES}$     | $V_{CE}=0V, V_{GE}=\pm 20V$                                                                             |      |                      | 100          | nA   |

| Parameter                       | Symbol    | Conditions                                                                    | Min. | Typ. | Max. | Unit |
|---------------------------------|-----------|-------------------------------------------------------------------------------|------|------|------|------|
| <b>Dynamic</b>                  |           |                                                                               |      |      |      |      |
| Input Capacitance               | $C_{ies}$ | $V_{CE}=25V, V_{GE}=0V$ ,<br>$f=1MHz$                                         | -    | 2.07 | -    | nF   |
| Reverse Transfer Capacitance    | $C_{res}$ |                                                                               | -    | 0.83 | -    |      |
| Gate Charge                     | $Q_G$     | $V_{CC}=300V, I_C=50A$ ,<br>$V_{GE}=15V$                                      | -    | 0.21 | -    | uC   |
| Short Circuit Collector Current | $I_{SC}$  | $V_{GE}=15V, t_{sc}\leq 5\mu s$ ,<br>$V_{CC}=400V, T_j\leq 150^\circ\text{C}$ | -    | 250  | -    | A    |

**Electrical Characteristics of the Diode** ( $T_j = 25^\circ\text{C}$  unless otherwise specified):

| Parameter             | Symbol | Conditions                                                                                                 | Min. | Typ.                 | Max. | Unit |
|-----------------------|--------|------------------------------------------------------------------------------------------------------------|------|----------------------|------|------|
| <b>Static</b>         |        |                                                                                                            |      |                      |      |      |
| Diode Forward Voltage | $V_F$  | $I_F = 50\text{A}$<br>$T_j = 25^\circ\text{C}$ ,<br>$T_j = 125^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ |      | 1.80<br>1.75<br>1.75 | 2.50 | V    |

**Switching Characteristic, Inductive Load**

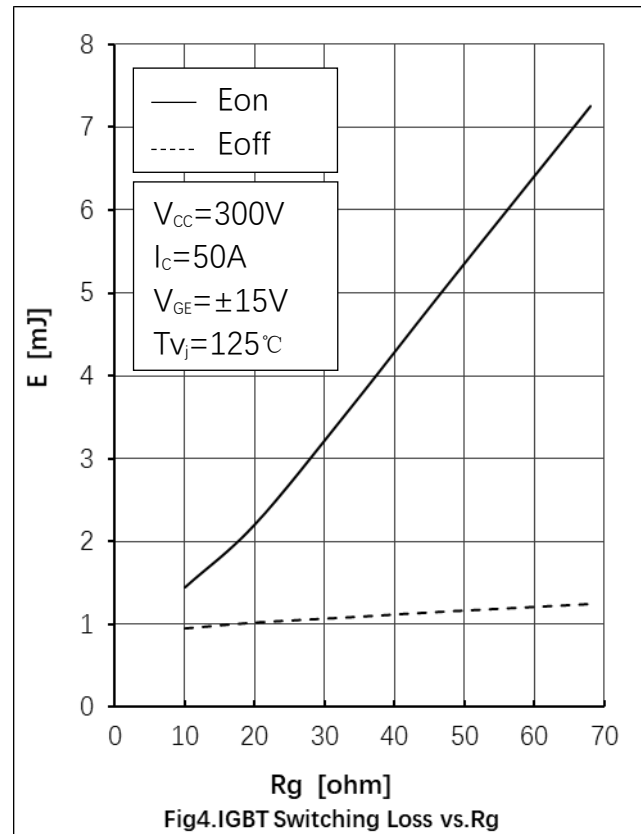
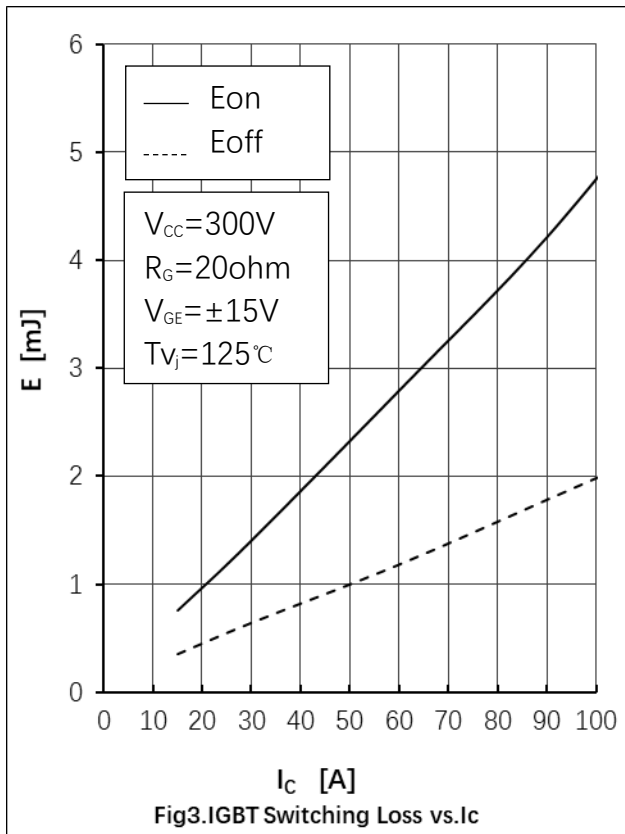
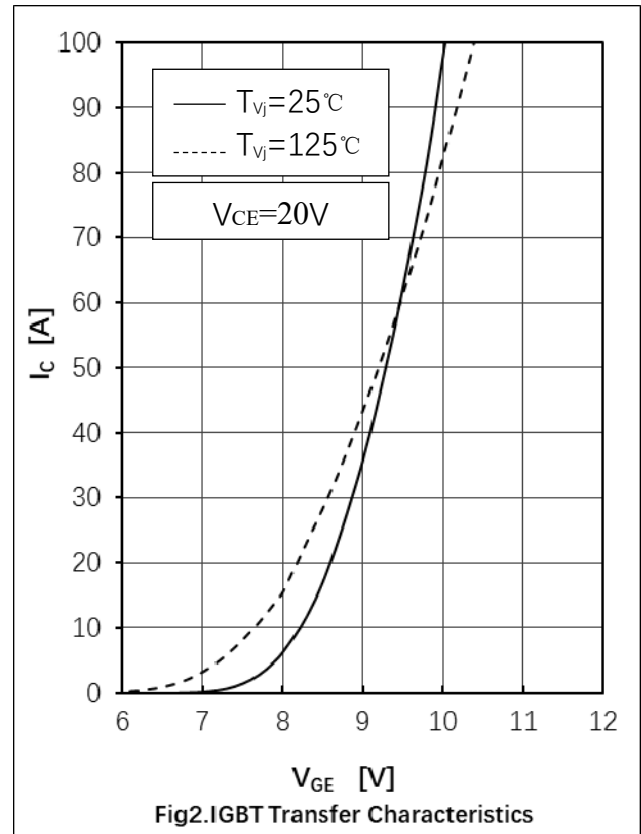
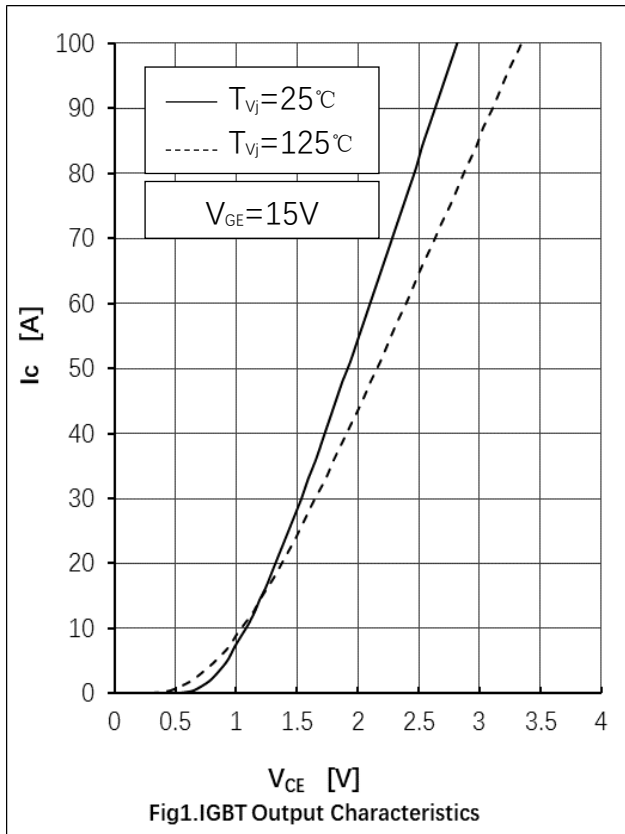
| Parameter                          | Symbol              | Conditions                                                                                                   | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Dynamic , at T <sub>j</sub> = 25℃  |                     |                                                                                                              |      |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>CC</sub> =300V, I <sub>C</sub> =50A,<br>V <sub>GE</sub> = -15v~15V,<br>R <sub>g</sub> =20Ω,Ls=60nH    | -    | 28   | -    | ns   |
| Rise Time                          | t <sub>r</sub>      |                                                                                                              | -    | 50   | -    | ns   |
| Turn-on Energy                     | E <sub>on</sub>     |                                                                                                              | -    | 1.49 | -    | mJ   |
| Turn-off Delay Time                | t <sub>d(off)</sub> |                                                                                                              | -    | 129  | -    | ns   |
| Fall Time                          | t <sub>f</sub>      |                                                                                                              | -    | 51   | -    | ns   |
| Turn-off Energy                    | E <sub>off</sub>    |                                                                                                              | -    | 0.67 | -    | mJ   |
| Dynamic , at T <sub>j</sub> = 125℃ |                     |                                                                                                              |      |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>CC</sub> =300V, I <sub>C</sub> =50A,,<br>V <sub>GE</sub> = -15v~15V,<br>R <sub>g</sub> =33 Ω ,Ls=60nH | -    | 35   | -    | ns   |
| Rise Time                          | t <sub>r</sub>      |                                                                                                              | -    | 60   | -    | ns   |
| Turn-on Energy                     | E <sub>on</sub>     |                                                                                                              | -    | 2.21 | -    | mJ   |
| Turn-off Delay Time                | t <sub>d(off)</sub> |                                                                                                              | -    | 220  | -    | ns   |
| Fall Time                          | t <sub>f</sub>      |                                                                                                              | -    | 60   | -    | ns   |
| Turn-off Energy                    | E <sub>off</sub>    |                                                                                                              | -    | 1.02 | -    | mJ   |
| Dynamic , at T <sub>j</sub> = 150℃ |                     |                                                                                                              |      |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>CC</sub> =300V, I <sub>C</sub> =50A,,<br>V <sub>GE</sub> = -15v~15V,<br>R <sub>g</sub> =33 Ω ,Ls=60nH | -    | 38   | -    | ns   |
| Rise Time                          | t <sub>r</sub>      |                                                                                                              | -    | 64   | -    | ns   |
| Turn-on Energy                     | E <sub>on</sub>     |                                                                                                              | -    | 2.54 | -    | mJ   |
| Turn-off Delay Time                | t <sub>d(off)</sub> |                                                                                                              | -    | 230  | -    | ns   |
| Fall Time                          | t <sub>f</sub>      |                                                                                                              | -    | 63   | -    | ns   |
| Turn-off Energy                    | E <sub>off</sub>    |                                                                                                              | -    | 1.15 | -    | mJ   |

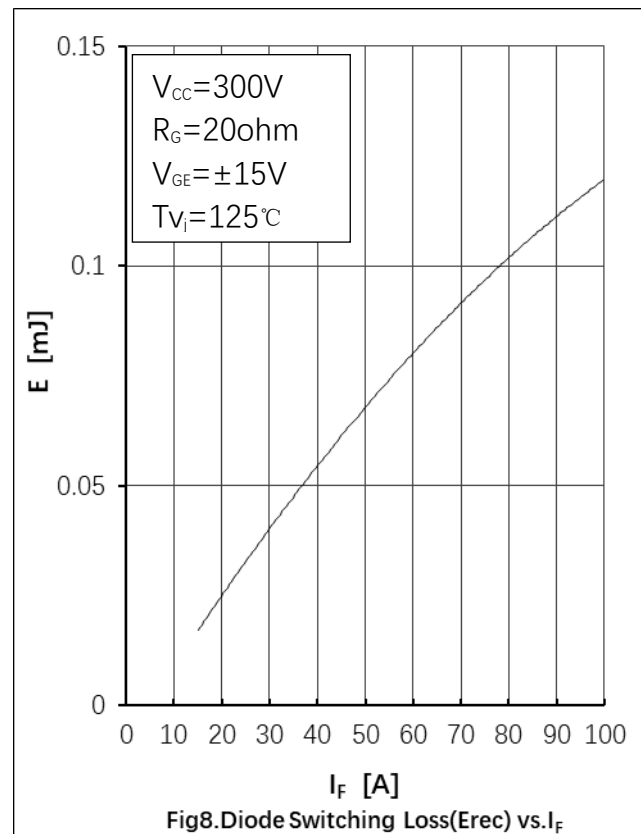
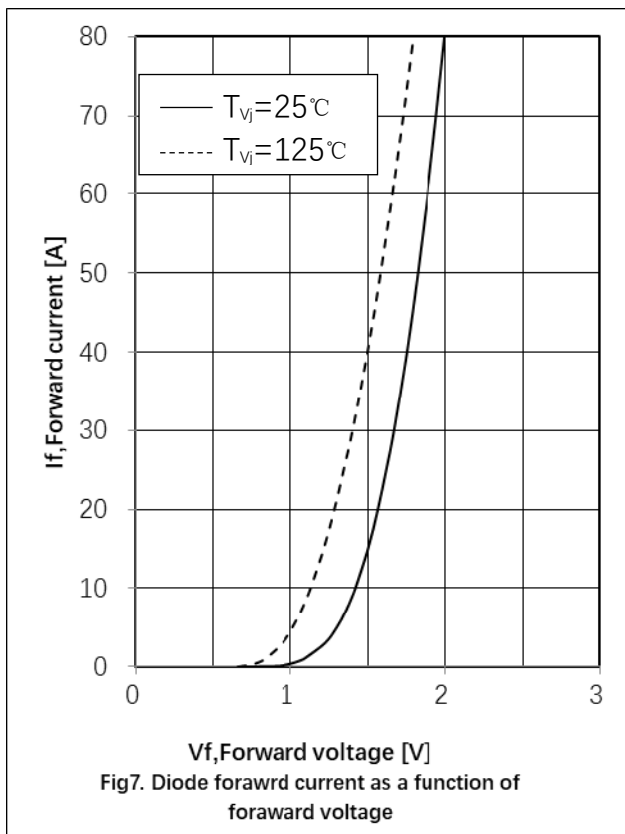
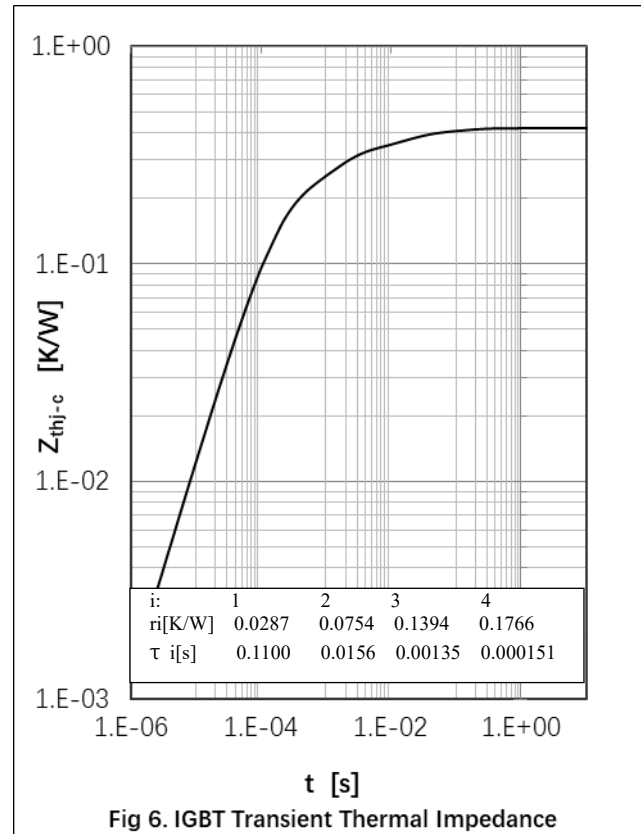
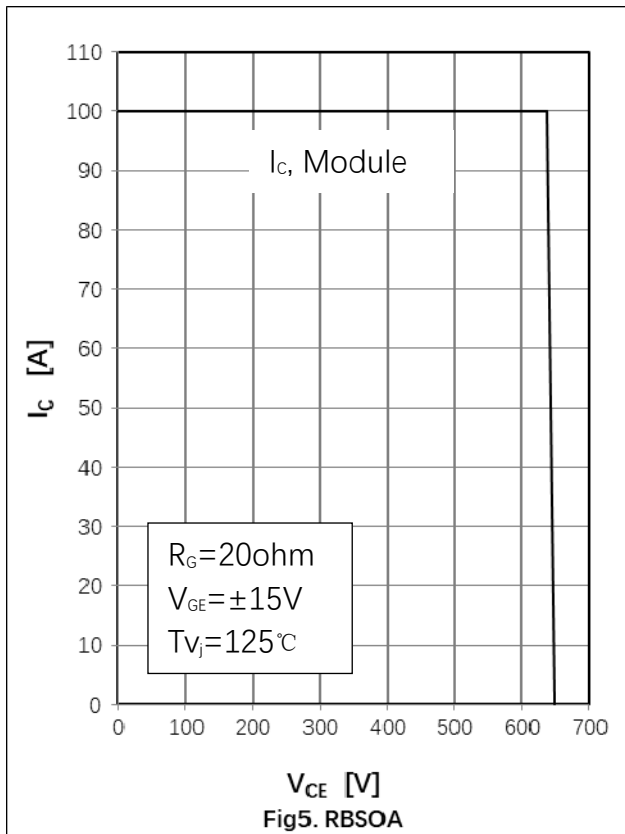
**Electrical Characteristics of the DIODE**

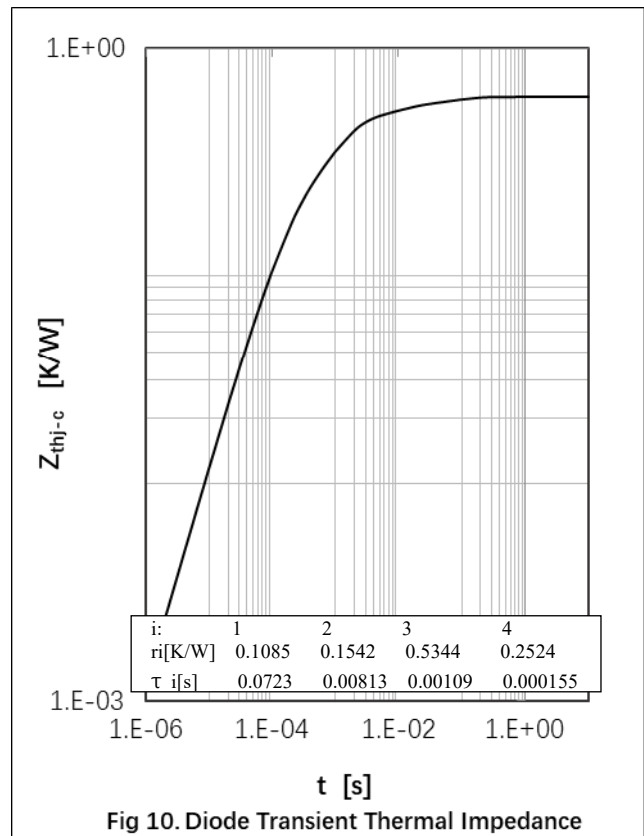
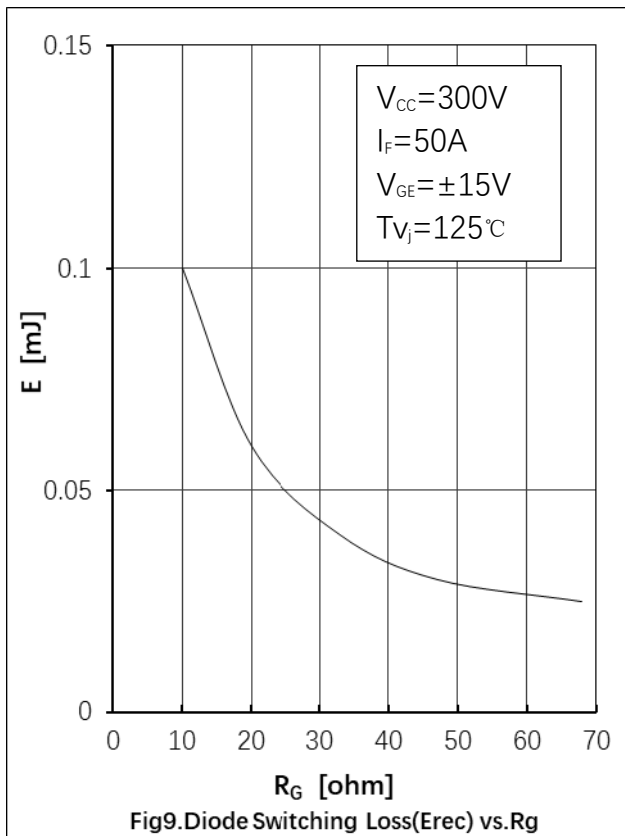
| Parameter                           | Symbol           | Conditions                                                    | Min. | Typ. | Max. | Unit |
|-------------------------------------|------------------|---------------------------------------------------------------|------|------|------|------|
| Dynamic , at T <sub>j</sub> = 25°C  |                  |                                                               |      |      |      |      |
| Reverse Recovery Current            | I <sub>rr</sub>  | I <sub>F</sub> =50A, V <sub>R</sub> =300V<br>di/dt= -750A/μs, | -    | 12   | -    | A    |
| Reverse Recovery Charge             | Q <sub>rr</sub>  |                                                               | -    | 0.7  | -    | uC   |
| Diode reverse recovery time         | trr              |                                                               | -    | 135  | -    | ns   |
| Reverse Recovery Energy             | E <sub>rec</sub> |                                                               | -    | 0.12 |      | mJ   |
| Dynamic , at T <sub>j</sub> = 125°C |                  |                                                               |      |      |      |      |
| Reverse Recovery Current            | I <sub>rr</sub>  | I <sub>F</sub> =50A, V <sub>R</sub> =300V<br>di/dt= -750A/μs, | -    | 18   | -    | A    |
| Reverse Recovery Charge             | Q <sub>rr</sub>  |                                                               | -    | 1.41 | -    | uC   |
| Diode reverse recovery time         | trr              |                                                               | -    | 163  | -    | ns   |
| Reverse Recovery Energy             | E <sub>rec</sub> |                                                               | -    | 0.25 |      | mJ   |
| Dynamic , at T <sub>j</sub> = 150°C |                  |                                                               |      |      |      |      |
| Reverse Recovery Current            | I <sub>rr</sub>  | I <sub>F</sub> =50A, V <sub>R</sub> =300V<br>di/dt= -750A/μs, | -    | 20   | -    | A    |
| Reverse Recovery Charge             | Q <sub>rr</sub>  |                                                               | -    | 1.56 | -    | uC   |
| Diode reverse recovery time         | trr              |                                                               | -    | 174  | -    | ns   |
| Reverse Recovery Energy             | E <sub>rec</sub> |                                                               | -    | 0.31 |      | mJ   |

**Thermal Resistance**

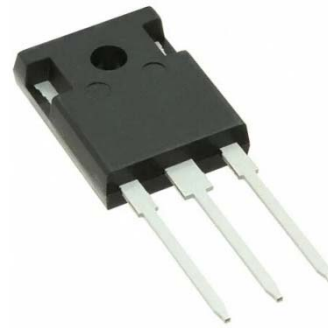
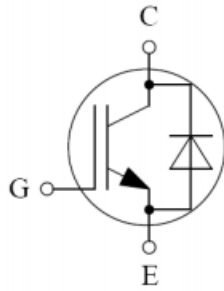
| Parameter                                 | Symbol               | Max. Value | Unit |
|-------------------------------------------|----------------------|------------|------|
| IGBT Thermal Resistance, Junction - Case  | R <sub>th(j-c)</sub> | 0.42       | K/W  |
| Diode Thermal Resistance, Junction - Case | R <sub>th(j-c)</sub> | 0.59       | K/W  |
| Thermal Resistance, Junction - Ambient    | R <sub>th(j-a)</sub> | 40         | K/W  |







## ● Circuit Diagram



## ● Package Outline Information

CASE: TO 247

